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10/576,230

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Atsushi Yabe

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EXAMINER

BAREFORD, KATHERINE A

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

10/20/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/576,230	Applicant(s) YABE ET AL.	
	Examiner Katherine A. Bareford	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 August 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 5 and 6 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 5 and 6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>8/7/08</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The amendments of August 7, 2008 have been received and entered. With the entry of the amendments, claims 1-4 have been canceled, and claim 5 and new claim 6 are pending for examination.

Specification

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

In the amendment of August 7, 2008, no amendment was provided to the title, so the rejection remains.

Claim Rejections - 35 USC § 112

3. The rejection of claim 4 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention is withdrawn due to the cancellation of claim 4 in the amendment of August 7, 2008.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al (US 4834796) in view of Uzoh et al (US 2003/0160326), Maenosono (US 2001/0021466) and WO 01/49898 (hereinafter '898).

Kondo teaches an electroless copper plating method. Column 1, lines 5-15. An electroless copper plating solution is provided. Column 2, lines 20-25 and column 13, line 30 through column 14, line 10. The plating solution can comprise a first reducing agent (formalin) and a second hypophosphite reducing agent. Column 13, line 30 through column 14, line 10. The plating solution can also comprise a stablizer (2,2'-bipyridyl), which would inhibit copper deposition. Column 13, lines 55-60 and column 6, lines 25-40 (as the material claimed by applicant for this purpose --see claim 5-- is

used). The surface to be plated is plated with the plating solution. Column 9, lines 45-60. The addition of the second hypophosphite reducing agent provides desirable acceleration of the plating reaction when used with a TEA complexing agent. Column 13, line 65 through column 14, line 10 and Figure 9. Kondo also shows catalyzing the surface to be plated with palladium before the electroless plating. Column 9, lines 45-55.

Kondo teaches all the features of this claim except the coating of the mirror surface with the claimed surface roughness and the plating thickness of 500 nm or less, and the application of the noble metal/silane pretreatment agent before the electroless plating.

However, Uzoh teaches that it is well known when providing copper electroless plating that it is desirable to overplate substrates formed from silicon wafers, for example. Paragraphs [0005]--[0006]. The desirable copper plating can be 2-250 nm for a seed layer and 200 nm, for example, on a seed layer from a plating bath. Paragraphs [0006] and [0008].

Furthermore, Maenosono teaches that silicon wafers and other substrates with a roughness Ra (average surface roughness) of 10 nm or less, preferably 5 nm or less, are commonly coated by electrochemical deposition methods, for example. Paragraph [0030].

Furthermore, '898 teaches a desirable pretreatment agent to provide palladium on a surface with a mirror finish such as a semiconductor wafer is by using a pretreatment agent with a noble metal compound (including palladium as the noble

metal) reacted or mixed in advance with a silane coupling agent having a functional group with metal capturing capability. Abstract and Example 5, pages 12-13. The pretreatment agent is applied to the substrate and then electroless plating is performed. Abstract. The plating can be using copper. Example 5, pages 12-13.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kondo to provide plating over a silicon wafer substrate with a mirror surface (roughness less than 10 nm) to provide a thin film of less than 500 nm thick as suggested by Uzoh and Maenosono in order to provide a desirable plating on such silicon substrates as Kondo teaches a desirable copper electroless plating bath, with plating conditions that can provide nm thickness coatings based on amounts of reducing agent used and time of plating (see range of Figure 9) and Uzoh teaches that it is well known to desire to provide electroless copper plating of 200 nm thickness, for example, over silicon wafer surfaces, and Maenosono teaches that silicon wafer surfaces to be coated can desirably have average surface roughness of less than 5 nm, for example. Furthermore, it would also have been obvious to modify Kondo in view of Uzoh and Maenosono to use a silane coupling agent pretreatment agent as suggested by '898 in order to provide a desirable adherence of the plating when desiring to coat such a mirrored surface, because Kondo teaches to provide a catalyst of palladium before plating, for example, and '898 teaches a desirable way to adhere a catalyst such as palladium using silane coupling agent as claimed before electrolessly plating as a treatment to a mirrored finish surface.

7. WO 01/49898 was provided by applicant with the IDS statement of April 14, 2006.

8. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo in view of Uzoh, Maenosono and '898 as applied to claim 6 above, and further in view of Yoshida et al (US 2002/0011176) and Verbunt (US 2004/0152303).

Kondo in view of Uzoh, Maenosono and '898 teaches all the features of this claim except the specific first reducing agent and the use of hypophosphorous acid as the second reducing agent. Kondo does teach the stabilizing agent of 2,2'-bipyridyl. Column 13, lines 55-60 and column 6, lines 25-40.

However, Yoshida teaches that when providing copper electroless plating solutions, it is known to exchange formalin for glyoxylic acid as a reducing agent to provide a less problematic material, and that glyoxylic acid has a structure similar to formalin and is believed to having a oxidation reaction mechanism similar to formalin; however, the plating reaction proceeds more slowly than with formalin. Paragraphs [0004]-[0007].

Furthermore, Verbunt teaches that when providing copper electroless plating solutions it is well known to provide hypophosphite in the form of sodium hypophosphite or to provide the hypophosphite from hypophosphorous acid. Paragraphs [0023] and [0026].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kondo in view of Uzoh, Maenosono and '898 to use glyoxylic acid as the first reducing agent as suggested by Yoshida in order to provide a desirable less problematic reducing agent because Kondo teaches to provide a reducing agent of formalin, and Yoshida teaches that it is well known to replace formalin with glyoxylic acid as a reducing agent with an expectation of similar reaction mechanism, but with less problems. One of ordinary skill in the art would expect the hypophosphite second reducing agent in Kondo to act in the same beneficial speeded reaction way with glyoxylic acid, because formalin has a similar reaction mechanism, and this speeded reaction is desired because glyoxylic acid solutions proceed more slowly. It would further have been obvious to modify Kondo in view of Uzoh, Maenosono, '898 and Yoshida to further replace the hypophosphite of Kondo with hypophosphorous acid as suggested by Verbunt with an expectation of desirable plating results, because Verbunt shows that hypophosphorous acid is a known desirable source for hypophosphite in copper electroless plating baths.

Response to Arguments

9. Applicant's arguments filed August 7, 2008 have been fully considered but they are not persuasive.

Applicant argues that in Kondo, sodium hypophosphite is added to the formaldehyde reducing agent merely to reduce the content of formaldehyde, and

Figures 9 and 10 indicate that the plating rate for the combined material is almost equal to that of formaldehyde alone, and no unexpected results occur. The Examiner has reviewed these arguments, however, the rejection is maintained. Kondo provides extensive discussion at column 13, line 28 through column 14, line 10 as to the addition of sodium hypophosphite to the reducing agent of formaldehyde and notes at column 14, lines 5-10, that "From FIG. 9, it is certain that sodium hypophosphite, although it does not act alone, effectively accelerates the plating reaction if used in combination with formalin." Figure 9 further shows (in the solid line) that the deposition rate is significantly and measurably higher when sodium hypophosphite is added when used with a TEA complexing agent. This clearly provides a motivation to replace formalin alone with a combination of formalin/sodium hypophosphite with an expectation of improved results.

As to the treating of a mirror surface, applicant argues that Kondo has no disclosure as to treating a mirror surface with very small surface roughness and citing the reference as providing that "generally, an article or substrate to be treated . . . is pretreated (cleaned and mechanically roughened). . . " (apparently citing column 7, lines 55-60). The Examiner has reviewed these arguments, however, the rejection is maintained. Kondo provides that the procedures of plating can be conventional (column 7, lines 53-55), going on to provide that "generally, an article or substrate to be treated . . . is pretreated (cleaned and mechanically roughened). . . ". However, this statement as to roughening is merely exemplary ("generally" certainly does not mean

all the time) and as noted in MPEP 2123 (II) "Disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. In re Susi, 440 F.2d 442, 169 USPQ 423 (CCPA 1971)." Here, for example '898 shows that pretreatment of mirrored finish surfaces using the noble metal/silane is also a "conventional" treatment.

As to the comparative examples of applicant using formalin or glyoxylic acid alone producing inferior results, while Kondo's plating with formalin alone did not, the Examiner has reviewed this argument, however, the rejection is maintained. The question is not whether different examples that do not include all the features of the claimed invention give different results, but rather is the claimed invention suggested by the combination of the references. It is the Examiner's position that the combination of the references does provide the suggestion of the claimed invention for the reasons discussed in the rejection above.

As to Uzoh being different because the Kondo reference is concerned with articles or substrates having chemically roughened surfaces, the Examiner has reviewed this argument, however, the rejection is maintained. As discussed above, Kondo is not limited to roughened surfaces and the art used in the combination provides the conventionality of treating mirrored surfaces.

As to Maenosono disclosing electrochemical deposition and not electroless plating, the Examiner would understand that in the art of electrochemical deposition, electrochemical deposition is understood to be inclusive of electroless plating (As a

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courtesy, the Examiner notes Ruoff (US 6284345) column 10, lines 1-3, as exemplary as to this issue). Furthermore, at the least, it indicates the plating of thin films on silicon wafers with roughness of 10 nm or less, and '898 also teaches the desire to electrolessly plate mirrored finish surfaces. As to the thin film layer of Maenosono not being adherent, the Examiner disagrees. Maenosono, in its process, peels an applied polyimide layer from the substrate (paragraph [0010]), and when the substrate is inclusive of then thin film, it would appear from the wording in paragraph [0030] that the resistance (adhesion) of the thin film to the polyimide is low, since it is the polyimide film that is removed and adhesion during peeling of the polyimide that is referred to. Again as to Kondo being limited to substrates with a chemically roughened surface, the Examiner disagrees for the reasons discussed above.

As to the discussion of '898, the applicant again argues that Kondo is limited to substrates with a chemically roughened surface, and the Examiner disagrees for the reasons discussed above.

As to the further rejection of claim 5 using Yoshida and Verbunt, applicant argues that they do not cure the deficiencies contained in Kondo, Uzoh and Maenosono above. The Examiner disagrees as the rejection using Kondo, Uzoh, Maenosono and '898 is maintained for the reasons discussed above.

As to the comparative examples, the Examiner notes that one of ordinary skill in the art is already suggested to use the extra hypophosphite/hypophosphorous with an expectation of improved deposition rate as discussed in the rejection above. Therefore,

the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katherine A. Bareford whose telephone number is (571) 272-1413. The examiner can normally be reached on M-F(6:00-3:30) First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy H. Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Katherine A. Bareford/
Primary Examiner, Art Unit 1792